REMARKS

File History

The last substantive Office action was that of 6/12/2003. In the latest substantive Office action of 11/18/2004, the following allowances, rejections, objections and other actions appear to have been made:

> Independent Claim 11 was allowed.

> Dependent Claims 44-45 were allowed *despite their dependence on rejected Claim 1.*

> Claims 46-52 were allowed.

> Claims 1-10, 12-43 and 53-58 were rejected under 35 USC §103(a) as being obvious over Chao et al (US 6,291,030 based on an application filed 12/21/1999) as combined with Liu et al (US 6,211,040 based on an application filed 9/20/1999).

> A characterization was made of what Applicant appeared to be arguing in the last substantive response of August 2003.

Summary of Current Response

Claims 1, 12 and 53 are amended.

Arguments are presented concerning the applied art and its proposed combination.

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Applicants' Overview of Outstanding Office Action

Applicant sees the outstanding Office action of 11/18/2004 as having the following major features:

(1) There is no discussion of the specifics of any claim *taken in whole (i.e., what is the meaning of "filling")*. Instead, a sweeping conclusion is made that all claims (other than 11, 44-52) are obvious.

(2) No objective evidence of motivation to combine or modify is provided and no assertion of motivation to combine or modify is made. Instead, a conclusory declaration is made that:

> It would have been within the scope of one of ordinary skill in the art to combine the teachings Chao et al and Liu et al, to enable ... to be performed, and to provide an effective and very manufacturable method of depositing silicon dioxide ... [the latter being a lifting of text from the Summary of Invention of] (Liu et al, Col. 2, lines 59-62)."
>
> (Office action, page 4, top paragraph; *underlining and bracketed text added.*)

(3) No response is made to Applicants' previous assertion that Chao and Liu cannot be combined because they teach away from one another. No rebuttal is made to Applicants' previous characterizations of Chao and Liu. Instead, that pre-existing part of the administrative record is ignored.

(4) The PTO proposes that selection of any and all parameters is inherently and prima facie obvious because "it is a matter of determining optimum process conditions by routine experimentation" (Office action, page 4, bottom paragraph; and also page 5, last full paragraph).

In view of the above, it is respectfully submitted that a prima facie case of unpatentability has not been made out.

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Previous Arguments and Current PTO position on them

Looking closer at the details, the outstanding Office action seems to view Applicant as having last argued only that "neither Chao nor Liu ['040] teach the use of an E/D [etch/deposition] ratio of about 0.07 or less during the filling of the trenches with different aspect ratios." (OA page 5, last 3 lines, *underlining and brackets added.* The term "filling" will come into issue here as will be seen shortly.)

The Office action further asserts that 0.07 is **within the range 0.01 to 0.10** (OA page 3, lines 5-6 of bottom paragraph). The action asserts that **no unexpected results** have been shown (OA page 5) and that the 0.07 number is one that could be picked as a mater of obvious design choice and ascertainable by routine experimentation.

Applicants' counter position on Prosecution History

The only rational that Applicant currently sees out of this evolving prosecution history is that the PTO (US Patent and Trademark Office) is now interpreting the phrase, "during the filling of said different trenches" of Claim 1, for example, as encompassing not-filling and instead creating voids. That is what Chao does in the middle step of his 3-step method. Chao intentionally creates voids in order to reduce capacitance. Applicant has already asserted, over a year ago, that the low S/D ratio (<0.1) of Chao is established **for the purpose of intentionally inducing formation of voids 503** in the inter-metal dielectric and of thereby reducing the effective dielectric constant (k) of the inter-metal dielectric. (See Chao col. 3, line 45.)

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Claims must be read in whole. However, it is not clear from the latest Office action whether the PTO is making a finding of fact opposite to the above re Chao or whether the

PTO is choosing to interpret the term "filling" as having a meaning beyond its ordinary and accustomed meaning; construing the term "filling" as encompassing not-filling and instead creating voids. Clarification is respectfully requested. It is not fair to leave Applicant in a dark room shooting arrows at unseen and moving targets. Applicant does not understand what the PTO's current rationale is for broadly rejecting all claims other than 11, 46-52 and 44-45, where the latter depend from rejected claim 1.

Definition of Fill / Filling

Rejected **Claims 1, 12, 43 and 53** include the term "filling" or "overfilling" or "filled". In rejecting any claims; it is incumbent upon the PTO to first and foremost arrive at a reasonable interpretation of claim terms. Absent a clear indication that Applicant has chosen to act as his own lexicographer, words in a claim should take on their ordinary and accustomed meanings.

The Merriam-Webster Online Dictionary, 10th Edition (http://www.m-w.com/cgi-bin/dictionary) provides the following excerpted definitions for "fill" (underlining added for emphasis):

> Function: *verb*
>
> Etymology: Middle English, from Old English *fyllan;* akin to Old English *full* full *transitive senses*
>
> **1 a :** to put into as much as can be held or conveniently contained <*fill* a cup with water> **b :** to supply with a full complement <the class is already *filled*> **c** (1) : <..cut..> **e :** to repair the cavities of (teeth) ...
>
> **3 a :** to occupy the whole of <smoke *filled* the room> **b :** to spread through **c :** to make full <a mind *filled* with fantasies> ....

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The outstanding Office action seems to have some very different, but unspecified, definition for the term "fill" or "filling" which Applicant cannot comprehend. Clarification is respectfully requested.

Non-Prejudicial Amendment to Claims

Not withstanding the above, **Claim 1** is amended here to clarify that step (b) of using ions to sputter etch ... during the deposition is such as to fill the trenches with the formed silicon dioxide without creating voids of substantial size during said filling of said different trenches. In Applicant's opinion, this amendment is not made for purpose of patentability over prior art (ala Festo) but rather for the purpose of mooting conjectures as to how the PTO might be interpreting the term "filling". The amendment makes it clear that filling does not mean creating voids of substantial size. The ordinary meaning of "filling" was such beforehand and thus no new mater is being introduced.

Not withstanding the above, **Claim 12** is also amended here to clarify that step (c) of "controlling the etch and the deposition of the silicon dioxide ... during the filling of said at least two trenches" is one where said filling does not create voids of substantial size in said two trenches of differing widths. Once again, in Applicant's opinion, this amendment is not made for purpose of patentability over prior art (ala Festo) but rather for the purpose of mooting conjectures as to how the PTO might be interpreting the term "filling". The amendment makes it clear that filling does not mean creating voids of substantial size. The ordinary meaning of "filling" was such beforehand and thus no new mater is being introduced.

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Not withstanding the above, **Claim 53** is similarly amended here to clarify that the thereby provided, "substantially planar set oxide-filled trenches" upon which other layers of material are founded are such where said oxide-filled trenches do not have voids of substantial size defined therein. Once again, in Applicant's opinion, this amendment is not made for purpose of patentability over prior art (ala Festo) but rather for the purpose of mooting conjectures as to how the PTO might be interpreting the term "oxide-filled". The amendment makes it clear that the oxide-filled trenches do not have voids of substantial size defined therein. The ordinary meaning of "oxide-filled" was such beforehand and thus no new mater is being introduced.

Unexpected Results

In view of the uncontested fact that Chao teaches that the S/D range of "under 0.1" to "around 0.0" creates substantial voids in the form of "air gap 503" (Chao, col. 3, lines 40-52) when carried out within the full context of his process, it is inherently unexpected and surprising that the "nonzero etch to deposition ratio of about 0.07 or less" recited in Claim 1 provides a filling action without creating voids of substantial size during said filling of said different trenches.

The combination of Chao, col. 3, lines 40-52 and Applicants' claim language constitutes unrebutted evidence of unexpected results.

Moreover, per **MPEP §2144.05 (II)(B)**: "A particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. In re Antonie, 559 F.2d 618, 195 USPQ 6 (CCPA 1977)". In the present case Chao does not recognize an S/D value of under 0.1 as being

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effective for realizing the result of "filling" without leaving voids. Instead Chao teaches that an S/D value of under 0.1 will create an air gap. Thus the current rational for rejection violates the guidelines of MPEP §2144.05 (II)(B).

Moreover, the present application shows that the use of the claimed recipes allows for more planar polishing via CMP despite the differing trench dimensions. See "The inventors have discovered ..." at specification page 7, top paragraph. It is not understood how the PTO can summarily decide that all discoveries are a matter of routine experimentation.

Applicants' Earlier Remarks on Proposed Combination

Another issue on which Applicants disagree with the PTO is the characterization of Applicants' previous arguments and the taking of words outside of context. Here is the full text of what Applicant previously argued:

> Applicant respectfully disagrees that it is legally permissible to combine Chao with Liu in the manner proposed. Liu '040 teaches away from Chao and vise versa. Liu '040 teaches keeping the E/D ratio in the range 0.12 to 0.15 (col. 4, line 46). Liu '040 teaches to avoid forming voids (col. 2, lines 66-67). Chao contrastingly teaches to intentionally form voids in the middle one of 3 deposited layers of dielectric. In other words, Chao teaches to use a low E/D ratio only when intentionally creating voids in a middle one of 3 dielectric layers. Neither of Chao and Liu teaches to use a specific E/D ratio for the purpose of filling trenches of differing aspect ratios and/or trenches of differing widths. Thus, even if Chao and Liu could be somehow combined and their contradictions resolved, the combination would fail to fully replicate the recited subject matter. [Underlining added]

It should be clear that Applicant was arguing the inappropriateness of combining Chao with Liu. Applicant was using the term "filling" in its ordinary sense.

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It is well established that references which teach away from one another cannot be combined with a blind eye towards their conflicting teachings. See **MPEP §2145** (X)(D)(2):

("It is improper to combine references where the references teach away from their combination. In re Grasselli, 218 USPQ 769, 779 (Fed. Cir. 1983)") See also In re Rouffet 47 PQ2d 1453 (Fed. Cir. 1998). Moreover, it is well established that obviousness must be determined on the record as a whole, giving due consideration to all arguments and evidence. Applicants' previous arguments are simply being ignored.

Failure to Recite Motivations for Each and Every Claim

Applicant is at a loss to make sense of the assertion at Office action, page 4, top paragraph that "It would have been within the scope of one of ordinary skill in the art to combine the teachings Chao et al and Liu et al, to enable ... to be performed, and to provide an effective and very manufacturable method of depositing silicon dioxide ... (Liu et al, Col. 2, lines 59-62)." (*Underlining added.*)

This does not define a motivation to combine. Instead, it defines some arbitrary "scope". What relevance does this conjectured scope have to patentability? Where is the *reason* for combining? Where is the objective evidence that supports the nonexistent reason for combining? What does "to provide an effective and very manufacturable method of depositing silicon dioxide" mean? Applicant has no idea and is not under obligation to speculate.

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Admissions by PTO

At page 3, last 6 lines, the PTO admits to the following deficiencies in Chao and fails to provide any explanation of what, absent hindsight, would have led the ordinary artisan to modify Chao alone or in combination with a properly combined other reference, so as to arrive at the claimed subject matter taken in whole:

(1) 625 sccm as recited in Claim 4, 500 sccm as recited in Claim 5;

(2) using a high frequency bias signal power of 2000 watts or less as recited in Claim 6; [using a high frequency bias signal power of 1500 watts or less as recited in Claim 7]

(3) using an oxygen to silane ratio of 1.3 or less as recited in Claim 14;

(4) causing the heights of oxide-filled trenches to be within about 600Å of reference top surfaces of the adjacent to silicon regions as recited in Claim 55.

(5) causing a first of said trenches has a width in the range of about 1800Å to 3300Å and a second of said trenches has a width in the range of about 6600Å to 8800Å as recited in Claim 42.

In view of the admissions and failure to state motivations for combination and modification, prima facie cases of obviousness have not been presented.

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Incorrect Fact Finding re the Primary Chao Reference

The outstanding rejections appear to be founded on a number of findings of fact which Applicant also takes issue with.

At page 2 of the Office action, bottom paragraph, --and also at page 3, bottom paragraph-- it is asserted that Chao discloses "deposition of silicon dioxide ... ranges from 0.01 to 0.1 ... during the filling of said different trenches" (pointing to col. 3, lines 40-43; underlining added). Applicant fails to see the "0.01" value or the 0.1 value. Chao says "**under** 0.1" (emphasis added) but does not say exactly how far under. Chao says "more preferably **around** 0.0." (emphasis added). More importantly, Chao teaches that this unspecified, "very low" S/D ratio results in the formation of an air gap 503. It is not understood how the intentional formation of voids constitutes "during the filling". It is respectfully submitted that there has been an error in fact finding and an error of claim interpretation. Reconsideration is respectfully requested.

Given that all outstanding rejections are founded on the above-identified, incorrect reading of Chao, they should all be withdrawn at least for that reason alone.

CONCLUSION

In light of the foregoing, Applicant respectfully requests that the rejections be withdrawn. Should any other action be contemplated by the Examiner, it is respectfully requested that he contacts the undersigned at (408) 392-9250 to discuss the application.

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